Claims

What is claimed is:

1.   A method of restoring debugging breakpoints, said method comprising:

   having a breakpoint that is set to a selected step of a program; and

   automatically restoring, after modification of the program, the breakpoint to the selected step, wherein the selected step is at a different location within the modified program.

2.   The method of claim 1, wherein said automatically restoring comprises locating the selected step within the modified program, said locating comprising comparing at least one attribute of one or more attributes of the selected step to at least one attribute of one or more attributes of one or more lines of code of the modified program to locate the selected step.

3.   The method of claim 1, wherein the automatically restoring comprises:

locating the selected step within the modified program; and

setting the breakpoint at that location.

4.   The method of claim 3, wherein the locating comprises using an instruction profile to locate the selected step.

5.   The method of claim 4, wherein the instruction profile comprises one or more attributes of one or more machine instructions generated for the selected step.

6.   The method of claim 5, wherein said locating comprises comparing at least one attribute of the one or more attributes of the instruction profile to at least one attribute of one or more attributes of one or more machine instructions of one or more lines of code of the modified program to locate the selected step.

7.   The method of claim 5, further comprising choosing a number of machine instructions of the selected step to be included in the instruction profile.

8. The method of claim 7, wherein the choosing comprises:

selecting a number of instructions to be included in a calibration profile;

generating the calibration profile for a chosen line of the program, said calibration profile having the selected number of instructions for said chosen line;

comparing one or more attributes of said calibration profile to one or more attributes of at least one line of code of the program to obtain a result;

determining whether the result is an unambiguous result; and

repeating, zero or more times, said selecting, said generating, said comparing, and said determining until the determining indicates an unambiguous result, wherein the selected number of instruction increases at each iteration, and wherein the selected number of instructions indicates, when there is an indication of an unambiguous result, the number of machine instructions to be included in the instruction profile.

9.   The method of claim 1, wherein the different location comprises a different line number within the modified program.

10.   The method of claim 1, wherein said having the breakpoint set comprises requesting, by a user, that the breakpoint be set at the selected step.

11.   The method of claim 1, wherein said automatically restoring is performed by a debugger.

12.   The method of claim 11, wherein the debugger is a distributed debugger.

13. A method of facilitating debugging of programs, said method comprising:

using a debugger to step through a program until it reaches a breakpoint at a selected step; and

re-running the debugger, subsequent to revising the program, to step through the revised program until it reaches the breakpoint at the selected step, said breakpoint automatically restored, subsequent to the revising, to the selected step, regardless of the location of the selected step within the revised program.

14. A system of restoring debugging breakpoints, said
system comprising:

        a breakpoint set to a selected step of a
    program; and

        means for automatically restoring, after
    modification of the program, the breakpoint to the
    selected step, wherein the selected step is at a
    different location within the modified program.

    15. The system of claim 14, wherein said means for
automatically restoring comprises means for locating the
selected step within the modified program, said means for
locating comprising means for comparing at least one
attribute of one or more attributes of the selected step to
at least one attribute of one or more attributes of one or
more lines of code of the modified program to locate the
selected step.

    16. The system of claim 14, wherein the means for
automatically restoring comprises:

        means for locating the selected step within
    the modified program; and

        means for setting the breakpoint at that
    location.

17.   The system of claim 16, wherein the means for locating comprises means for using an instruction profile to locate the selected step.

18.   The system of claim 17, wherein the instruction profile comprises one or more attributes of one or more machine instructions generated for the selected step.

19.   The system of claim 18, wherein said means for locating comprises means for comparing at least one attribute of the one or more attributes of the instruction profile to at least one attribute of one or more attributes of one or more machine instructions of one or more lines of code of the modified program to locate the selected step.

20.   The system of claim 18, further comprising means for choosing a number of machine instructions of the selected step to be included in the instruction profile.

21. The system of claim 20, wherein the means for choosing comprises:

means for selecting a number of instructions to be included in a calibration profile;

means for generating the calibration profile for a chosen line of the program, said calibration profile having the selected number of instructions for said chosen line;

means for comparing one or more attributes of said calibration profile to one or more attributes of at least one line of code of the program to obtain a result;

means for determining whether the result is an unambiguous result; and

means for repeating, zero or more times, the selecting, the generating, the comparing, and the determining until the determining indicates an unambiguous result, wherein the selected number of instruction increases at each iteration, and wherein the selected number of instructions indicates, when there is an indication of an unambiguous result, the number of machine instructions to be included in the instruction profile.

22. The system of claim 14, wherein the different location comprises a different line number within the modified program.

23. The system of claim 14, further comprising means for requesting, by a user, that the breakpoint be set at the selected step.

24. The system of claim 14, wherein said means for automatically restoring is provided within a debugger.

25. The system of claim 24, wherein the debugger is a distributed debugger.

26. A system of facilitating debugging of programs, said system comprising:

means for using a debugger to step through a program until it reaches a breakpoint at a selected step; and

means for re-running the debugger, subsequent to revising the program, to step through the revised program until it reaches the breakpoint at the selected step, said breakpoint automatically restored, subsequent to the revising, to the selected step, regardless of the location of the selected step within the revised program.

27. A system of restoring debugging breakpoints, said
system comprising:

a breakpoint set to a selected step of a
program; and

a debugger to automatically restore, after
modification of the program, the breakpoint to the
selected step, wherein the selected step is at a
different location within the modified program.

28. A system of facilitating debugging of programs, said system comprising:

a debugger to step through a program until it reaches a breakpoint at a selected step; and

the debugger to be re-run, after the program is revised, to step through the revised program until it reaches the breakpoint at the selected step, the breakpoint automatically restored, subsequent to revision of the program, to the selected step, regardless of the location of the selected step within the revised program.

29. At least one program storage device readable by a machine tangibly embodying at least one program of instructions executable by the machine to perform a method of restoring debugging breakpoints, said method comprising:

having a breakpoint that is set to a selected step of a program; and

automatically restoring, after modification of the program, the breakpoint to the selected step, wherein the selected step is at a different location within the modified program.

30. The at least one program storage device of claim 29, wherein said automatically restoring comprises locating the selected step within the modified program, said locating comprising comparing at least one attribute of one or more attributes of the selected step to at least one attribute of one or more attributes of one or more lines of code of the modified program to locate the selected step.

31. The at least one program storage device of claim 29, wherein the automatically restoring comprises:

locating the selected step within the modified program; and

setting the breakpoint at that location.

32. The at least one program storage device of claim 31, wherein the locating comprises using an instruction profile to locate the selected step.

33. The at least one program storage device of claim 32, wherein the instruction profile comprises one or more attributes of one or more machine instructions generated for the selected step.

34. The at least one program storage device of claim 33, wherein said locating comprises comparing at least one attribute of the one or more attributes of the instruction profile to at least one attribute of one or more attributes of one or more machine instructions of one or more lines of code of the modified program to locate the selected step.

35. The at least one program storage device of claim 33, wherein said method further comprises choosing a number of machine instructions of the selected step to be included in the instruction profile.

36. The at least one program storage device of claim
35, wherein the choosing comprises:

selecting a number of instructions to be
included in a calibration profile;

generating the calibration profile for a
chosen line of the program, said calibration
profile having the selected number of instructions
for said chosen line;

comparing one or more attributes of said
calibration profile to one or more attributes of
at least one line of code of the program to obtain
a result;

determining whether the result is an
unambiguous result; and

repeating, zero or more times, said
selecting, said generating, said comparing, and
said determining until the determining indicates
an unambiguous result, wherein the selected number
of instruction increases at each iteration, and
wherein the selected number of instructions
indicates, when there is an indication of an
unambiguous result, the number of machine
instructions to be included in the instruction
profile.

37. The at least one program storage device of claim
29, wherein the different location comprises a different
line number within the modified program.

38. The at least one program storage device of claim
29, wherein said having the breakpoint set comprises
requesting, by a user, that the breakpoint be set at the
selected step.

39. The at least one program storage device of claim
29, wherein said automatically restoring is performed by a
debugger.

40. The at least one program storage device of claim
39, wherein the debugger is a distributed debugger.

41. At least one program storage device readable by a machine tangibly embodying at least one program of instructions executable by the machine to perform a method of facilitating debugging of a program, said method comprising:

using a debugger to step through a program until it reaches a breakpoint at a selected step; and

re-running the debugger, subsequent to revising the program, to step through the revised program until it reaches the breakpoint at the selected step, said breakpoint automatically restored, subsequent to the revising, to the selected step, regardless of the location of the selected step within the revised program.

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